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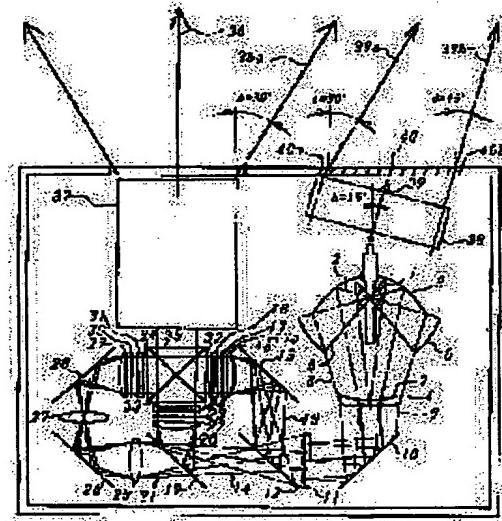
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**(54) LIQUID CRYSTAL PROJECTOR****(57)Abstract:**

**PROBLEM TO BE SOLVED:** To prevent hot blast from adversely influencing the periphery and to display a picture without fluctuation by arranging a ventilating fan proximately to a projection lens so that the fan may be inclined to the optical axis direction of the projection lens.

**SOLUTION:** In order to prevent heat generated from a light source from exerting an influence on component parts other than the light source, the ventilating fan for cooling the light source 38 is arranged near a metal halide lamp 1 being the light source and lamp reflectors 3 and 5 so as to discharge the hot blast 39 to the outside of the housing of the liquid crystal projector. The fan 38 is arranged adjacently to the projection lens 37 to be inclined so that exhaust air 39 from the fan 38 may go away from the projected light 36 from the lens 37. The inclination angle of the fan 38 is set to  $b=15^\circ$  with reference to the angle  $a=30^\circ$  of the projection light 36a of the projected light 36 on the exhaust air 39 side so as to prevent a situation that the hot blast 39 exhausted from the fan 38 flows into the projected light 36 from the lens 37 and the projected picture to a screen is fluctuated.

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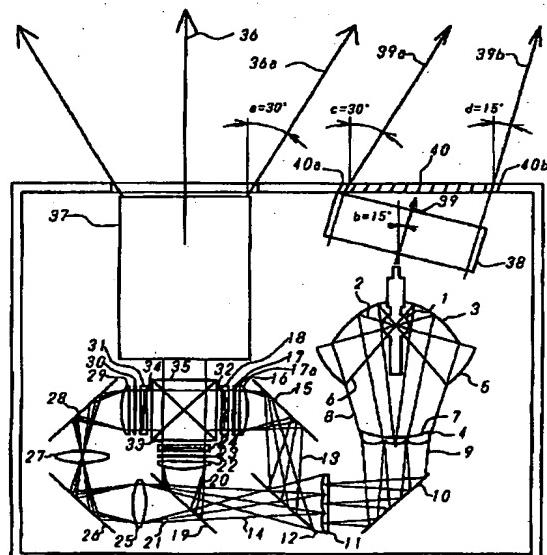
(54)【発明の名称】 液晶プロジェクタ

(57)【要約】

【課題】排気風による投写画像のゆらぎの防止と、冷却効率の向上。

【解決手段】排気ファンを投写レンズ光軸に対し傾斜して配置。風向板も、投写レンズに近い側のものの傾斜角度を、投写レンズから遠い側のものの傾斜角度よりも大きくする。

図1



## 【特許請求の範囲】

【請求項1】光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズでスクリーン上に投写する液晶プロジェクタにおいて、

装置内空気を外部に排氣する排氣ファンであって、投写レンズに近接しかつその排氣流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜して配された排氣ファンを備えた構成を特徴とする液晶プロジェクタ。

【請求項2】光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズでスクリーン上に投写する液晶プロジェクタにおいて、

装置内空気を外部に排氣する排氣ファンであって、投写レンズに近接して配された排氣ファンと、該排氣ファンの排氣流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜して配された風向板と、

を備えたことを特徴とする液晶プロジェクタ。

【請求項3】光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズによりスクリーン上に投写する液晶プロジェクタにおいて、

装置内空気を外部に排氣する排氣ファンと、該排氣ファンの排氣流が投写レンズの投写光から遠ざかるよう投写レンズ光軸方向に対し傾斜して配されるとともに、投写レンズに近い側のものの傾斜角度と、投写レンズから遠い側のものの傾斜角度とが異なるようにされた複数の風向板と、

を備えたことを特徴とする液晶プロジェクタ。

【請求項4】光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズによりスクリーン上に投写する液晶プロジェクタにおいて、

装置内空気を外部に排氣する排氣ファンと、該排氣ファンの排氣流が投写レンズの投写光から遠ざかるよう投写レンズ光軸方向に対し傾斜して配されるとともに、投写レンズに近い側のものの傾斜角度が、投写レンズから遠い側のものの傾斜角度よりも大きくされた複数の風向板と、

を備えたことを特徴とする液晶プロジェクタ。

【請求項5】光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズでスクリーン上に投写する液晶プロジェクタにおいて、

装置内空気を外部に排氣する排氣ファンであって、投写レンズに近接しかつその排氣流が投写レンズの投写光から遠ざかるよう投写レンズ光軸方向に対し傾斜して配された排氣ファンと、

該排氣ファンによる排氣流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜して配された風向板と、

を備えたことを特徴とする液晶プロジェクタ。

【請求項6】光源からの光を液晶パネルに照射し、該液

晶パネルからの出射光を投写レンズでスクリーン上に投写する液晶プロジェクタにおいて、装置内空気を外部に排氣する排氣ファンであって、投写レンズに近接しかつその排氣流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜して配された排氣ファンと、該排氣ファンの排氣流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜して配され、かつ投写レンズに近い側のものの傾斜角度と、投写レンズから遠い側のものの傾斜角度とを異ならせるようにした複数の風向板と、

を備えたことを特徴とする液晶プロジェクタ。

【請求項7】光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズでスクリーン上に投写する液晶プロジェクタにおいて、

装置内空気を外部に排氣する排氣ファンであって、投写レンズに近接しかつその排氣流が投写レンズの投写光から遠ざかるよう投写レンズ光軸方向に対し傾斜して配された排氣ファンと、

装置カバーの開口部に設けられ、該排氣ファンの排氣流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜して配され、かつ投写レンズに近い側のものの傾斜角度を、投写レンズから遠い側のものの傾斜角度よりも大きくした複数の風向板と、

を備えたことを特徴とする液晶プロジェクタ。

【請求項8】光源からの光を、第1のレンズアレイ、第1の反射ミラー、第2のレンズアレイを介して第1のダイクロイックミラーに入射させ、該第1のダイクロイックミラーにより色分離された第1の出射光を第2の反射ミラーを介し第1の液晶パネルに照射し、該第1のダイクロイックミラーにより色分離された第2の出射光を第2のダイクロイックミラーに入射させ、該第2のダイクロイックミラーにより色分離された第1の出射光を第2の液晶パネルに入射させ、該第2のダイクロイックミラーにより色分離された第2の出射光を第3の反射ミラー、第4の反射ミラーを介し第3の液晶パネルに照射し、上記第1の液晶パネルからの透過光、上記第2の液晶パネルからの透過光、及び上記第3の液晶パネルからの透過光を、ダイクロイックプリズムによって色合成し、該色合成された出射光を投写レンズによりスクリーン上に投写する液晶プロジェクタであって、上記第1の反射ミラー、第2のレンズアレイ、第1のダイクロイックミラー、第2のダイクロイックミラー、第3の反射ミラーをこの順に配し、かつ第1の反射ミラー、第1のレンズアレイ、光源、排氣ファンをこの順に配置し、かつ第1の反射ミラー、第1のレンズアレイ、光源、排氣ファンの並びが、投写レンズ、ダイクロイックプリズム、第2のダイクロイックミラーの並びに対し略平行でかつ隣りに配されるようにしたことを特徴とする液晶プロジェクタ。

【請求項9】上記第1のダイクロイックミラーは、B色光を反射し、G色光とR色光を透過する分光特性を有し。

上記第2のダイクロイックミラーは、G色光を反射し、R色光を透過する分光特性を有する請求項8に記載の液晶プロジェクタ。

【請求項10】上記第1の反射ミラーを増反射銀ミラーとし、上記第3の反射ミラーと上記第4の反射ミラーのうちいずれか一方を増反射銀ミラーとし他方を赤外線を透過するコールドミラーとした請求項8に記載の液晶プロジェクタ。

【請求項11】上記第1の反射ミラーを増反射銀ミラーとし、上記第1の液晶パネルの入射側に配置される偏光板と第1のダイクロイックミラーとの光路間に、紫外線を遮断するUVカットフィルタを配置した請求項8に記載の液晶プロジェクタ。

#### 【発明の詳細な説明】

##### 【0001】

【発明の属する技術分野】本発明は、光源からの光を液晶パネルに照射し、該液晶パネルの出射光を投写レンズでスクリーン上に投写して画像表示する液晶プロジェクタに関する。

##### 【0002】

【従来の技術】従来、この種の透過型液晶パネルを用いた液晶プロジェクタとしては、例えば特開昭63-216026号公報記載のものがある。この従来構成では、光源(符号21)、第1の反射ミラー(23)、第1のダイクロイックミラー(26)、第2の反射ミラー(30)、第2のダイクロイックミラー(27)、第3の反射ミラー(28)、第4の反射ミラー(29)、第1の透過型の液晶パネル(33)、第2の透過型の液晶パネル(39)、第3の透過型の液晶パネル(45)、ダイクロイックプリズム(49)、投写レンズ(50)とを備え、光源からの照明光を第1の反射ミラーを介して第1のダイクロイックミラーに入射させ、第1のダイクロイックミラーにより色分離された第1の出射光を第2の反射ミラーを介して第1の液晶パネルに照射し、第1のダイクロイックミラーにより色分離された第2の出射光を第2のダイクロイックミラーに入射させ、第2のダイクロイックミラーにより色分離された第1の出射光を第2の液晶パネルに入射させ、第2のダイクロイックミラーにより色分離された第2の出射光を第3の反射ミラー、第4の反射ミラーを介して第3の液晶パネルに照射し、第1の液晶パネルからの透過光、第2の液晶パネルからの透過光、第3の液晶パネルからの透過光をダイクロイックプリズムにより色合成し、色合成された出射光を投写レンズによりスクリーン上に投写するようになっている。

【0003】また、特開平3-10218号公報記載のように、光源冷却用の排気ファン(15, 27)を設け

たものもある。

【0004】また、さらに、例えば、日本光学会(応物学会)主催のJAPAN OPTICS '94 光学連合シンポジウム浜松 '94(p135-p136)の22Fa06「異形開口レンズアレイを用いた液晶プロジェクタ用高効率照明光学系」に開示されているように、光源にメタルハライドランプと放物面鏡を用い、UV-IRカットフィルタ、第1のレンズアレイ、第2のレンズアレイを設けたものが知られている。

【0005】上記3件の公知例を組合せた構成の液晶プロジェクタも実用化されている。

【0006】以下、図面を用いて、この従来の技術を組合せた液晶プロジェクタにつき説明する。

【0007】図6は、従来の技術を組合せた液晶プロジェクタ光学系の上面図である。

【0008】光源であるメタルハライドランプ50からの照明光51は、放物面鏡のランプリフレクタ52、UV-IRカットフィルタ53、第1のレンズアレイ54、第1の反射ミラーであるコールドミラー55、第2のレンズアレイ56、第1のダイクロイックミラーであるR色光透過、G及びB色光反射のダイクロイックミラー57に入射し、R色光58が透過し、G及びB色光59が反射するようになっている。

【0009】R色光58は、第2の反射ミラーである増反射アルミニミラー60で反射され、コンデンサレンズ61、偏光板62を介して、第1の透過型の液晶パネルであるR色光用液晶パネル63に入射する。

【0010】G及びB色光59は、第2のダイクロイックミラーであるG色光反射、B色光透過のダイクロイックミラー64に入射し、G色光65が反射し、B色光66が透過する。G色光65は、コンデンサレンズ67、偏光板68を介して、第2の透過型の液晶パネルであるG色光用液晶パネル69に入射する。

【0011】B色光66は、リレーレンズ70、第3の反射ミラーである増反射アルミニミラー71、リレーレンズ72、第4の反射ミラーである増反射アルミニミラー73、コンデンサレンズ74、偏光板75を介して、第3の透過型の液晶パネルであるB色光用液晶パネル76に入射する。

【0012】液晶パネル63からのR透過光77と、液晶パネル69からのG透過光78と、液晶パネル76からのB透過光79は、ダイクロイックプリズム80により色合成され、色合成された出射光81を投写レンズ82によりスクリーン(図示せず)上に投写する。

【0013】高温になる光源から発生する熱が構成部品に影響ないようにするために、光源であるメタルハライドランプ50とランプリフレクタ52の近傍には、光源冷却用の排気ファン83が配置されており、液晶プロジェクタの筐体(図示せず)の外に熱風84を排気する。

【0014】この構成の液晶プロジェクタによれば、高温になる光源を冷却しながら、スクリーン上で明るく大画面の画像が得られる。

【0015】しかしながら、従来のこの構成の液晶プロジェクタにおいては、排気ファン83により排気された熱風84が、液晶プロジェクタの近傍に位置する観視者の方向に流れることがあり、観視者に不快感を与えてしまうという課題があった。

【0016】また、液晶プロジェクタは、パーソナルコンピュータ等の映像機器を近傍に置いて使用することがあるが、これらの熱に弱い機器を熱風が当たらない位置に置くなどの配慮が必要である。また、光源から発生する熱を効率良く排気するために、熱風が排気される位置には該排気を遮るような物を置かないようにする配慮も必要であり、使い勝手性の上で問題があった。

【0017】これに対して、例えば実開平5-59424号公報に開示されているように、投写レンズの前筒部を配置した面と同一面に、光源の冷却用としての排気用ファンを配置し、投写方向と排気方向とを同一方向とした構成が提案されている。これによれば、排気ファンから排気された熱風が、液晶プロジェクタの近傍に位置する観視者の方向に流れることなく、観視者に不快感を与えることもない。また、液晶プロジェクタの近傍に熱に弱い機器を配置する場合も配慮が不要で、また熱風が排気される位置に排気を遮るような物を置かないようにする配慮も不要な、使い勝手性の良い液晶プロジェクタが得られる。しかしながら、この従来技術では、投写レンズからの投写光の中に、排気ファンからの熱風が流れでスクリーンの投写画像にゆらぎが生ずることがある点についての対策等配慮がされていなかった。また、熱風をより効率良く排気させる構成についても特に配慮がなかった。また、第1のレンズアレイ及び第2のレンズアレイを含む光学系の構成についても配慮がなかった。

#### 【0018】

【発明が解決しようとする課題】本発明の目的は、排気ファンから排気される熱風が、観視者や、近傍に配される機器に悪影響を及ぼさず、スクリーンにゆらぎのない画像を表示でき、また、冷却のために装置内の空気を効率良く排気できる、高性能かつ使い勝手性の良い液晶プロジェクタを提供することにある。

#### 【0019】

【課題を解決するための手段】上記目的を達成するためには、光源からの光を液晶パネルに照射し、該液晶パネルからの出射光を投写レンズでスクリーン上に投写する液晶プロジェクタにおいて、(1)装置内空気を外部に排気する排気ファンを、投写レンズに近接して配しつつその排気流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾斜させて配する。

【0020】(2)排気ファンの排気流が投写レンズの投写光から遠ざかるよう、投写レンズ光軸方向に対し傾

斜して配した風向板を備える。

【0021】(3)排気ファンの排気流が投写レンズの投写光から遠ざかるよう投写レンズ光軸方向に対し傾斜して配するとともに、投写レンズに近い側のものの傾斜角度と、投写レンズから遠い側のものの傾斜角度とを異なるようにした複数の風向板を備える。

【0022】(4)排気ファンの排気流が投写レンズの投写光から遠ざかるよう投写レンズ光軸方向に対し傾斜して配するとともに、投写レンズに近い側のものの傾斜角度を、投写レンズから遠い側のものの傾斜角度よりも大きくした複数の風向板を備える。

【0023】(5)光源からの光を、第1のレンズアレイ、第1の反射ミラー、第2のレンズアレイを介して第1のダイクロイックミラーに入射させ、該第1のダイクロイックミラーにより色分離された第1の出射光を第2の反射ミラーを介し第1の液晶パネルに照射し、該第1のダイクロイックミラーにより色分離された第2の出射光を第2のダイクロイックミラーに入射させ、該第2のダイクロイックミラーにより色分離された第1の出射光を第2の液晶パネルに入射させ、該第2のダイクロイックミラーにより色分離された第2の出射光を第3の反射ミラー、第4の反射ミラーを介し第3の液晶パネルに照射し、上記第1の液晶パネルからの透過光、上記第2の液晶パネルからの透過光、及び上記第3の液晶パネルからの透過光を、ダイクロイックプリズムによって色合成し、該色合成された出射光を投写レンズによりスクリーン上に投写する液晶プロジェクタであって、上記第1の反射ミラー、第2のレンズアレイ、第1のダイクロイックミラー、第2のダイクロイックミラー、第3の反射ミラーをこの順に配し、かつ第1の反射ミラー、第1のレンズアレイ、光源、排気ファンをこの順に配置し、かつ第1の反射ミラー、第1のレンズアレイ、光源、排気ファンの並びが、投写レンズ、ダイクロイックプリズム、第2のダイクロイックミラーの並びに対し略平行でかつ隣りに配するようとする。

#### 【0024】

【発明の実施の形態】以下、図面を用いて本発明の実施例を説明する。

【0025】図1は、本発明の第1の実施例を示す図で、液晶プロジェクタ光学系の上面図である。

【0026】光源であるメタルハライドランプ1からの照明光2は、楕円面鏡のランプリフレクタ3を介して、第1レンズアレイ4に入射する。ここで、球面鏡のランプリフレクタ5は、メタルハライドランプ1からの従来は利用されていなかった照明光6を再度メタルハライドランプ1に戻し、光の再利用を図る目的で設けたものである。第1レンズアレイ4は、その入射面7が凹レンズ面とし、楕円面鏡のランプリフレクタ3からの収束光8を、略平行光に変換する作用を持たせることにより第1レンズアレイを小型にすることができる。

【0027】第1レンズアレイ4からの出射光9は、第1の反射ミラーである増反射銀ミラー10、第2レンズアレイ11、第1のダイクロイックミラーであるB色光反射、G及びR色光透過のダイクロイックミラー12に入射し、B色光13が反射し、GおよびR色光14が透過する。B色光13は、第2の反射ミラーである増反射アルミニミラー15で反射され、コンデンサレンズ16、偏光板17を介して、第1の透過型の液晶パネルであるB色光用液晶パネル18に入射する。G及びR色光14は、第2のダイクロイックミラーであるG色光反射、R色光透過のダイクロイックミラー19に入射し、G色光20が反射し、R色光21が透過する。G色光20は、コンデンサレンズ22、偏光板23を介して、第2の透過型の液晶パネルであるG色光用液晶パネル24に入射する。R色光21は、リレーレンズ25、第3の反射ミラーである赤外線を透過するコールドミラー26、リレーレンズ27、第4の反射ミラーである増反射銀ミラー28、コンデンサレンズ29、偏光板30を介して、第3の透過型の液晶パネルであるR色光用液晶パネル31に入射する。

【0028】液晶パネル18からのB透過光32と、液晶パネル24からのG透過光33と、液晶パネル31からのR透過光34は、ダイクロイックプリズム35により色合成され、色合成された出射光36を投写レンズ37によりスクリーン(図示せず)上に投写する。

【0029】高温になる光源から発生する熱が光源以外の構成部品に影響を及ぼさなくするために、光源であるメタルハライドランプ1、ランプリフレクタ3とランプリフレクタ5の近傍には、光源冷却用の排気ファン38が配置されており、液晶プロジェクタの筐体の外に熱風39を排氣する。排気ファン38を投写レンズ37に隣りに配置し、かつ排気ファン38の排気風39が投写レンズ37の投写光36から遠ざかるように、排気ファン38を傾斜して配置する。投写光36の排気風39側の投写光36aの角度 $a = 30^\circ$ に対して、排気ファンの傾斜角度 $b = 15^\circ$ と設定し、投写レンズ37からの投写光36の中に、排気ファン38から排氣した熱風39が流れてスクリーンへの投写画像がゆらぐのを防止できる。

【0030】また、排気ファン38を投写レンズ37に隣接して配置し、かつ排気ファン38の排気風39が投写レンズ37の投写光36から遠ざかるように、複数の風向板40を傾斜して配置するとともに、投写レンズ37に近い側の風向板40aの傾斜角度cを、投写レンズ37から遠い側の風向板40bの傾斜角度dよりも大きくしてある。例えば、傾斜角度 $c = 30^\circ$ 、傾斜角度 $d = 15^\circ$ としてある。投写光36の排気風39側の投写光36aの角度 $a = 30^\circ$ に対し、投写レンズ37に近い側の風向板40aの傾斜角度 $c = 30^\circ$ と略等しく設定してあるので、投写レンズ37からの投写光36の中

に、排気ファン38から廃棄した熱風39aが流れてスクリーンへの投写画像がゆらぐことを緩和できる。また、送風ファン38の傾斜角度 $b = 15^\circ$ に対して、投写レンズ37から遠い側の風向板40bの傾斜角度 $d = 15^\circ$ と略等しく設定したので、熱風39の進路が風向板40bにより大きく曲げられることないため、より効率よく排氣されるようになる。投写レンズ37からの投写光36の中に、排気ファン38から排氣した熱風39が流れてスクリーンへの投写画像がゆらぐ問題は、投写レンズ37側から遠い排気風39bの方が、投写レンズ37に近い排気風39bよりも影響が小さいために、このように風向板40aの傾斜角度cよりも風向板40bの傾斜角度dをより小さくする。

【0031】本実施例では、第1のダイクロイックミラー12により分離された第1の出射光13が第1のダイクロイックミラー12の反射光、第1のダイクロイックミラー12により分離された第2の出射光14が第1のダイクロイックミラー12の透過光となるように、第1の反射ミラー10、第2のレンズアレイ11、第1のダイクロイックミラー12、第2のダイクロイックミラー19、第3の反射ミラー26をこの順に配置し、かつ第1の反射ミラー10、第1のレンズアレイ4、光源であるメタルハライドランプ1、排気ファン38をこの順に配置し、かつ第1の反射ミラー10、第1のレンズアレイ4、光源であるメタルハライドランプ1、排気ファン38の並びが、投写レンズ37、ダイクロイックプリズム35、第2のダイクロイックミラー19の並びに対して略平行で、かつ隣りに配置してある。

【0032】本実施例構成の液晶プロジェクタによれば、排気ファン38により排氣された熱風39が投写レンズ37の出射光36と同じ方向に流れることになる。投写レンズ37の出射光36の方向の近傍に観視者が位置することは、観視者自身が出射光36を遮り、スクリーンへの画像に影を発生させることになるからあり得ない。従って、液晶プロジェクタの近傍に位置する観視者の方向に流れることがないため、該観視者に不快感を与えることがない。

【0033】また、同様の理由により、パーソナルコンピュータ等の映像機器を液晶プロジェクタの近傍に置いて使用しても、これら熱に弱い機器に熱風が当たることがなく、置く位置についての配慮が不要である。また、光源から発生する熱を効率良く排氣するために、熱風が排氣される位置には排氣を遮るような物を置かないようとする配慮も不要であり、使い勝手を向上させることができる。

【0034】また、本実施例では、第1のダイクロイックミラー12は、B色光を反射し、G色光とR色光を透過する分光特性とし、第2のダイクロイックミラー19は、G色光を反射し、R色光を透過する分光特性としたことにより、R色光成分に比べてB色光成分を相対的に

増やすことができる。これは、B色光のみが、各ミラー10, 12, 15で反射のみで利用することができ、かつP偏光成分に比べて反射率がより高いS偏光成分を利用できるためである。これにより、スクリーンに投写される白色を好ましい色温度に高める効果がある。特に、液晶プロジェクタに使用される光学部品のガラスやプラスチック材料には、B色光の光利用効率を低下させるもの（例えば偏光板や液晶パネル）があり、これらの材料の場合は、同じ色温度の光源を用いても色温度の低下は避けられなかった。しかし、本発明のかかる構成では、最大限にB色光成分を利用できるので、この色温度の低下を最小限に食い止めることができる。

【0035】なお、B色光やG色光に比べ、R色光では、リレーレンズ25, 27と反射ミラー26, 28を余分に使用することになるので、その透過率、反射率損失により、光量が低下する。

【0036】そこで、本実施例では、第1の反射ミラーを増反射銀ミラー10とし、第3の反射ミラーを赤外線を透過するコールドミラー26とし、第4の反射ミラーを増反射銀ミラー28とする。

【0037】図2は、増反射銀ミラーの分光反射率特性を示すグラフである。また、図3はコールドミラーの分光透過率のグラフである。この図より、増反射銀ミラーは、コールドミラーに比べて、反射率が高いことがわかる。特に、R色光はダイクロイックミラー12, 19の透過光を利用することになるので、S偏光成分に比べて透過率がより高いP偏光成分を利用すべきである。そこで、P偏光成分の反射率がより高い増反射銀ミラー10, 28を採用することによりR色光の低下を最小限に食い止めることができる。なお、増反射銀ミラー10, 28の採用に伴い、不要な赤外線と、紫外線の遮断が必要となる。そこで、本実施例では、第3の反射ミラーを赤外線を透過するコールドミラー26としてある。これにより、偏光板30、液晶パネル31に有害な赤外線が照射されないようにできる。

【0038】また、本実施例では、第1の液晶パネル18の入射側に配置される偏光板17と第1のダイクロイックミラー12との光路間に、紫外線を遮断するUVカットフィルタを配置してある。さらに、本実施例では、偏光板17の入射面にもUVカットフィルタ17aを形成してある。

【0039】なお、本第1の実施例では、排気ファン38の排気風39が投写レンズ37の投写光36から遠ざかるように、排気ファン38を傾斜して配置したり、複数の風向板40を傾斜して配置するとともに、投写レンズ37に近い側の風向板40aの傾斜角度cを、投写レンズ37から遠い側の風向板40bの傾斜角度dよりも大きく設定したが、これに限定されるものではない。

【0040】図4は、本発明の第2の実施例を示す図で、液晶プロジェクタ光学系の上面図である。排気ファン38が傾斜して配置されていない点と、風向板40の構成については図示していない点を除いて、本発明の第1の実施例と同じ構成である。本実施例では、第2の実施例と同様に、排気ファン38から排気された熱風39が、液晶プロジェクタの近傍に位置する観視者の方向に流れることなく、観視者に不快感を与えることない、また液晶プロジェクタの近傍に配置する機器に対する配慮が不要で、また熱風が排気される位置に排気を遮るような物を置かないようにする配慮も不要である。このように、本発明によれば使い勝手の良い液晶プロジェクタを得ることができる。

【0041】図5は、本発明の第3の実施例を示す図で、その光学系の上面図である。

【0042】光源のメタルハライドランプ50からの光51は、放物面鏡のランプリフレクタ52、UV-IRカットフィルタ53、第1のレンズアレイ54、第1の反射ミラーであるコールドミラー55、第2のレンズアレイ56、第1のダイクロイックミラーであるR色光反射、GおよびB色光透過のダイクロイックミラー40に入射し、R色光58が反射し、GおよびB色光59が透過する。R色光58は、第2の反射ミラーである増反射アルミミラー60で反射され、コンデンサレンズ61、偏光板62を介して、第1の透過型の液晶パネルであるR色光用液晶パネル63に入射する。GおよびB色光59は、第2のダイクロイックミラーであるG色光反射、B色光透過のダイクロイックミラー64に入射し、G色光65が反射し、B色光66が透過する。G色光65は、コンデンサレンズ67、偏光板68を介して、第2の透過型の液晶パネルであるG色光用液晶パネル69に入射する。B色光66は、リレーレンズ70、第3の反射ミラーである増反射アルミミラー71、リレーレンズ72、第4の反射ミラーである増反射アルミミラー73、コンデンサレンズ74、偏光板75を介して、第3の透過型の液晶パネルであるB色光用液晶パネル76に入射する。

【0043】液晶パネル63からのR透過光77と、液晶パネル69からのG透過光78と、液晶パネル76からのB透過光79は、ダイクロイックプリズム80により色合成され、色合成された出射光81を投写レンズ82によりスクリーン（図示せず）上に投写する。

【0044】高温の光源で発生する熱が光源以外の構成部品に影響を及ぼさないようにするために、光源のメタルハライドランプ50とランプリフレクタ52の近傍には、光源冷却用の排気ファン38が配置され、液晶プロジェクタの筐体（図示せず）の外に熱風39を排気するようになっている。

【0045】本実施例では、第1のダイクロイックミラー40により分離された第1の出射光58が第1のダイクロイックミラー40の反射光、第1のダイクロイックミラー40により分離された第2の出射光59が第1の

ダイクロイックミラー40の透過光となるように、第1の反射ミラー55、第2のレンズアレイ56、第1のダイクロイックミラー40、第2のダイクロイックミラー64、第3の反射ミラー71をこの順に配置し、かつ第1の反射ミラー55、第1のレンズアレイ54、光源のメタルハライドランプ50、排気ファン38をこの順に配置し、かつ第1の反射ミラー55、第1のレンズアレイ54、光源のメタルハライドランプ50、排気ファン38の並びが、投写レンズ82、ダイクロイックプリズム80、第2のダイクロイックミラー64の並びに対し略平行で、かつ隣りに配置してある。

【0046】本実施例によれば、排気ファン38により排気された熱風39が、投写レンズ82の出射光81と同じ方向に流れることになるので、上記第2の実施例の場合と同様の効果が得られる。

#### 【0047】

【発明の効果】以上、説明したように、本発明によれば、観視者に不快感を与えることなく、また近傍に配置する機器の温度上昇に対する配慮も不要にできる等、使い勝手性の良い液晶プロジェクタを得ることができるとともに、排気ファンから排気した熱風によるスクリーンの投写画像のゆらぎも防止できる。また、排気効率を高めて冷却効率を高めることができる。

#### 【図面の簡単な説明】

【図1】本発明の第1の実施例の液晶プロジェクタ光学系の上面図である。

【図2】増反射銀ミラーの分光反射率特性を示すグラフである。

【図3】コールドミラーの分光透過率のグラフである。

【図4】本発明の第2の実施例の液晶プロジェクタ光学系の上面図である。

【図5】本発明の第3の実施例の液晶プロジェクタ光学系の上面図である。

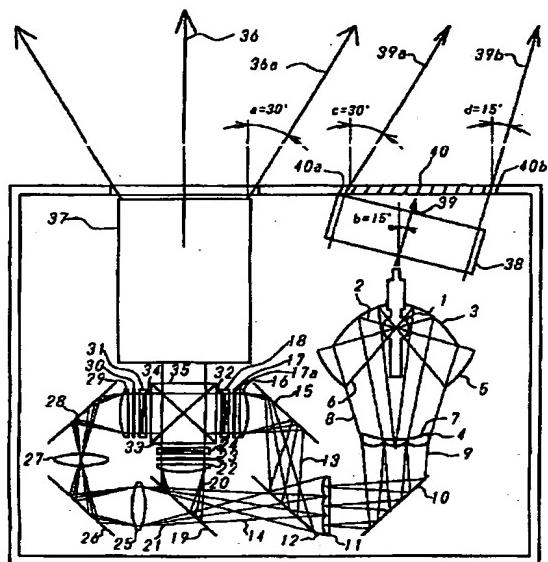
【図6】従来の液晶プロジェクタ光学系の上面図である。

#### 【符号の説明】

1…メタルハライドランプ、2…照明光、3…ランプリフレクタ、4…第1のレンズアレイ、5…ランプリフレクタ、6…照明光、7…入射面、8…収束光、9…出射光、10…増反射銀ミラー、11…第2のレンズアレイ、12…ダイクロイックミラー、13…B色光、14…GおよびR色光、15…増反射アルミミラー、16…コンデンサレンズ、17…偏光板、17a…UVカットフィルタ、18…B色光用液晶パネル、19…ダイクロイックミラー、20…G色光、21…R色光、22…コンデンサレンズ、23…偏光板、24…G色光用液晶パネル、25…リレーレンズ、26…コールドミラー、27…リレーレンズ、28…増反射銀ミラー、29…コンデンサレンズ、30…偏光板、31…R色光用液晶パネル、32…B透過光、33…G透過光、34…R透過光、35…ダイクロイックプリズム、36…出射光、36a…出射光、37…投写レンズ、38…排気ファン、39…熱風、39a…熱風、39b…熱風、40…風向板、40a…風向板、40b…風向板、a…角度、b…角度、c…角度、d…角度、50…メタルハライドランプ、51…照明光、52…ランプリフレクタ、53…UV-IRカットフィルタ、54…第1のレンズアレイ、55…コールドミラー、56…第2のレンズアレイ、57…ダイクロイックミラー、58…R色光、59…GおよびB色光、60…増反射アルミミラー、61…コンデンサレンズ、62…偏光板、63…R色光用液晶パネル、64…ダイクロイックミラー、65…G色光、66…B色光、67…コンデンサレンズ、68…偏光板、69…G色光用液晶パネル、70…リレーレンズ、71…増反射アルミミラー、72…リレーレンズ、73…増反射アルミミラー、74…コンデンサレンズ、75…偏光板、76…B色光用液晶パネル、77…R透過光、78…G透過光、79…B透過光、80…ダイクロイックプリズム、81…出射光、82…投写レンズ、83…排気ファン、84…熱風。

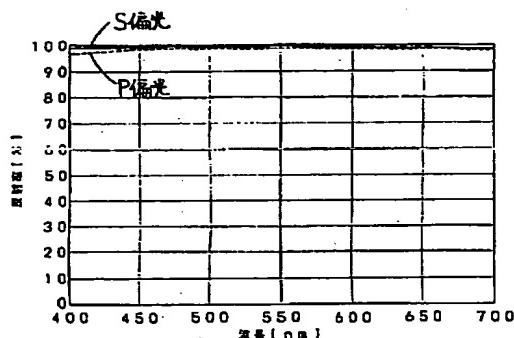
【図1】

図1



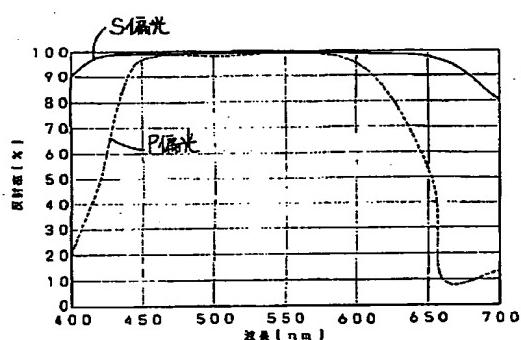
【図2】

図2



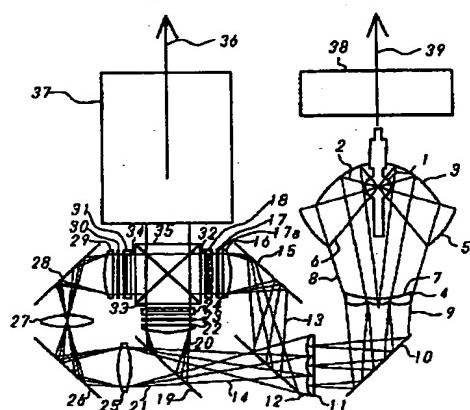
【図3】

図3



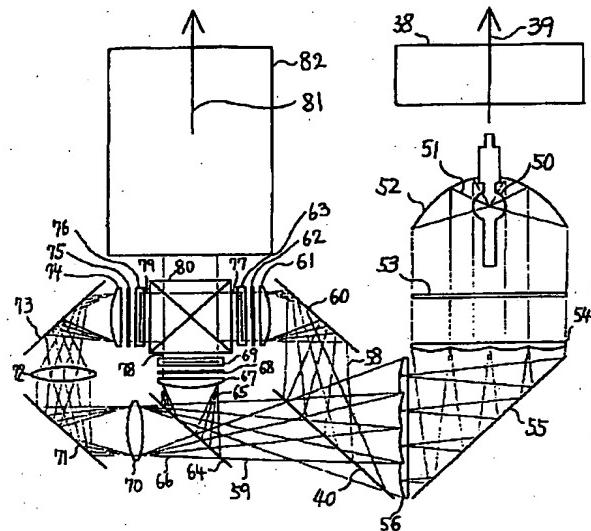
【図4】

図4



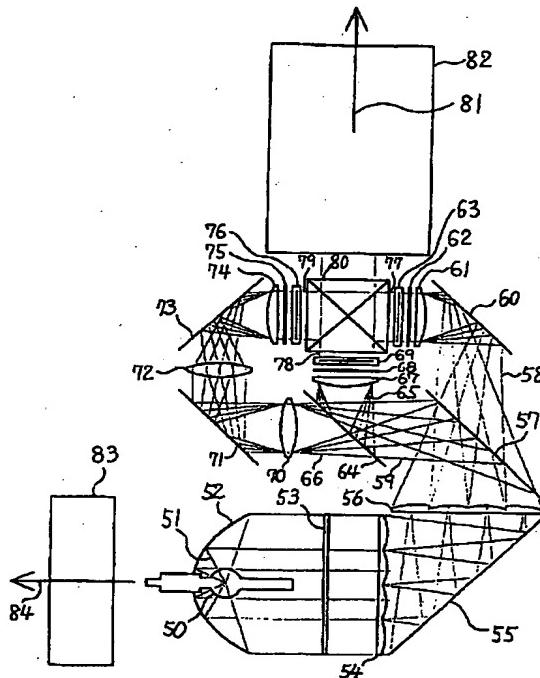
〔図5〕

5



【图6】

6



フロントページの続き

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**CLAIMS****[Claim(s)]**

[Claim 1] The liquid crystal projector characterized by the composition equipped with the ventilating fan allotted by inclining to the direction of a projection lens optical axis so that the light from the light source is irradiated at a liquid crystal panel, it might be the ventilating fan which exhausts the air in equipment outside in the liquid crystal projector which projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens, and a projection lens might be approached and the exhaust stream might keep away from the projection light of a projection lens.

[Claim 2] the wind direction allotted by inclining to the direction of a projection lens optical axis so that the light from the light source is irradiated at a liquid crystal panel, it might be the ventilating fan which exhausts the air in equipment outside in the liquid crystal projector which projects the outgoing-radiation light from this liquid crystal panel on a screen with a projection lens and the exhaust stream of the ventilating fan allotted by approaching a projection lens and this ventilating fan might keep away from the projection light of a projection lens -- the liquid crystal projector characterized by to have a board

[Claim 3] The liquid crystal projector which irradiates the light from the light source characterized by providing the following at a liquid crystal panel, and projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens The ventilating fan which exhausts the air in equipment outside two or more wind directions from which it was made for the degree of tilt angle of the thing of the side near a projection lens and the degree of tilt angle of the thing of a side far from a projection lens to differ while being inclined and allotted to the direction of a projection lens optical axis so that the exhaust stream of this ventilating fan might keep away from the projection light of a projection lens -- a board

[Claim 4] The liquid crystal projector which irradiates the light from the light source characterized by providing the following at a liquid crystal panel, and projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens The ventilating fan which exhausts the air in equipment outside two or more wind directions by which the degree of tilt angle of the thing of the side near a projection lens was made larger than the degree of tilt angle of the thing of a side far from a projection lens while being inclined and allotted to the direction of a projection lens optical axis so that the exhaust stream of this ventilating fan might keep away from the projection light of a projection lens -- a board

[Claim 5] The liquid crystal projector which irradiates the light from the light source characterized by providing the following at a liquid crystal panel, and projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens The ventilating fan which is a ventilating fan which exhausts the air in equipment outside, and was allotted by inclining to the direction of a projection lens optical axis so that a projection lens might be approached and the exhaust stream might keep away from the projection light of a projection lens the wind direction allotted by inclining to the direction of a projection lens optical axis so that the exhaust stream by this ventilating fan might keep away from the projection light of a projection lens -- a board

[Claim 6] The liquid crystal projector which irradiates the light from the light source characterized by providing the following at a liquid crystal panel, and projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens The ventilating fan allotted by inclining to the direction of a projection lens optical axis so that it was the ventilating fan which exhausts the air in equipment outside, and a projection lens might be approached and the exhaust stream might keep away from the projection light of a projection lens two or more wind directions inclined to the direction of a projection lens optical axis, and it is allotted [ wind directions ] and made to change the degree of tilt angle of the thing of the side near a projection lens, and the degree of tilt angle of the thing of a side far from a projection lens so that the exhaust stream of this ventilating fan might keep away from the projection light of a projection lens -- a board

[Claim 7] The liquid crystal projector which irradiates the light from the light source characterized by providing the following at a liquid crystal panel, and projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens The ventilating fan which is a ventilating fan which exhausts the air in equipment outside, and was allotted by inclining to the direction of a projection lens optical axis so that a projection lens might be approached and the exhaust stream might keep away from the projection light of a projection lens two or more wind directions which inclined to the direction of a projection lens optical axis, were allotted and made the degree of tilt angle of the thing of the side near a projection lens larger than the degree of tilt angle of the thing of a side far from a projection lens so that it might be prepared in opening of equipment covering and the exhaust stream of this ventilating fan might keep away from the projection light of a projection lens -- a board

[Claim 8] Incidence of the light from the light source is carried out to the 1st dichroic mirror through the 1st lens array, the 1st reflective mirror, and the 2nd lens array. The 1st outgoing radiation light by which color separation was carried out with this 1st dichroic mirror is irradiated through the 2nd reflective mirror at the 1st liquid crystal panel. Incidence of the 2nd outgoing radiation light by which color separation was carried out with this 1st dichroic mirror is carried out to the 2nd dichroic mirror. Incidence of the 1st outgoing radiation light by which color separation was carried out with this 2nd dichroic mirror is carried out to the 2nd liquid crystal panel. The 2nd outgoing radiation light by which color separation was carried out with this 2nd dichroic mirror The 3rd reflective mirror, The 3rd liquid crystal panel is irradiated through the 4th reflective mirror. The transmitted light from the 1st liquid crystal panel of the above, The transmitted light from the 2nd liquid crystal panel of the above, and the transmitted light from the 3rd liquid crystal panel of the above It is the liquid crystal projector which carries out color composition with a dichroic prism, and projects on a screen this outgoing radiation light by which color composition was carried out with a projection lens. The reflective mirror of the above 1st, the 2nd lens array, the 1st dichroic mirror, The 2nd dichroic mirror and the 3rd reflective mirror are allotted to this order. And the 1st reflective mirror, The 1st lens array, the light source, and a ventilating fan are arranged in this order. and the list of the 1st reflective mirror, the 1st lens array, the light source, and a ventilating fan The liquid crystal projector which is abbreviation parallel and is characterized by making it allotted next to the list of a projection lens, a dichroic prism, and the 2nd dichroic mirror.

[Claim 9] It is the liquid crystal projector according to claim 8 which has the spectral characteristic which the 1st dichroic mirror of the above reflects B colored light, it has the spectral characteristic which penetrates G colored light and R colored light, and the 2nd dichroic mirror of the above reflects G colored light, and penetrates R colored light.

[Claim 10] the increase of the reflective mirror of the above 1st -- reflection -- silver -- a mirror -- \*\* -- carrying out -- the inside of the reflective mirror of the above 3rd, and the reflective mirror of the above 4th -- the increase of either -- reflection -- silver -- a mirror -- \*\* -- the liquid crystal projector according to claim 8 which carried out and made another side the cold mirror which penetrates infrared radiation

[Claim 11] the increase of the reflective mirror of the above 1st -- reflection -- silver -- a mirror -- \*\* -- the liquid crystal projector according to claim 8 which has arranged UV cut-off filter which intercepts ultraviolet rays between the optical paths of the polarizing plate and the 1st dichroic mirror which carry out and are arranged at the incidence side of the 1st liquid crystal panel of the above

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[Translation done.]

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**DETAILED DESCRIPTION****[Detailed Description of the Invention]**

[0001]

[The technical field to which invention belongs] this invention irradiates the light from the light source at a liquid crystal panel, and relates to the liquid crystal projector which projects the outgoing radiation light of this liquid crystal panel on a screen, and carries out image display with a projection lens.

[0002]

[Description of the Prior Art] Conventionally, as a liquid crystal projector using this kind of penetrated type liquid crystal panel, there is a thing given in JP,63-216026,A, for example. With composition, conventionally [ this ] The light source (sign 21), the 1st reflective mirror (23), The 1st dichroic mirror (26), the 2nd reflective mirror (30), The 2nd dichroic mirror (27), the 3rd reflective mirror (28), The 4th reflective mirror (29), a 1st transparency type liquid crystal panel (33), a 2nd transparency type liquid crystal panel (39), A 3rd transparency type liquid crystal panel (45), a dichroic prism (49), Have a projection lens (50) and incidence of the lighting light from the light source is carried out to the 1st dichroic mirror through the 1st reflective mirror. The 1st outgoing radiation light by which color separation was carried out with the 1st dichroic mirror is irradiated through the 2nd reflective mirror at the 1st liquid crystal panel. Incidence of the 2nd outgoing radiation light by which color separation was carried out with the 1st dichroic mirror is carried out to the 2nd dichroic mirror. Incidence of the 1st outgoing radiation light by which color separation was carried out with the 2nd dichroic mirror is carried out to the 2nd liquid crystal panel. The 2nd outgoing radiation light by which color separation was carried out with the 2nd dichroic mirror The 3rd reflective mirror, The 3rd liquid crystal panel is irradiated through the 4th reflective mirror. The transmitted light from the 1st liquid crystal panel, the transmitted light from the 2nd liquid crystal panel, Color composition of the transmitted light from the 3rd liquid crystal panel is carried out with a dichroic prism, and the outgoing radiation light by which color composition was carried out is projected on a screen with a projection lens.

[0003] Moreover, there are some which prepared the ventilating fan for light source cooling (15 27) like a JP,3-10218,A publication.

[0004] Furthermore, JAPAN Japanese optical meeting (Japan Society of Applied Physics society)-sponsored [ for example, ] OPTICS A metal halide lamp and a parabolic mirror are used for the light source, and what prepared an UV-IR cut-off filter, the 1st lens array, and the 2nd lens array is known as indicated by 22Fa(s)06 "the efficient lighting optical system for liquid crystal projectors using the variant opening lens array" of '94 optical union symposium Hamamatsu '94 (p135-p136).

[0005] The liquid crystal projector of composition of having combined the well-known example of the three above-mentioned affairs is also put in practical use.

[0006] Hereafter, it explains per [ which combined this Prior art ] liquid crystal projector using a drawing.

[0007] Drawing 6 is the plan of the liquid crystal projector optical system which combined the Prior art.

[0008] Incidence of the lighting light 51 from the metal halide lamp 50 which is the light source is carried out to the dichroic mirror 57 of R colored light transparency which is the cold mirror 55 which are the lamp reflector 52 of a parabolic mirror, the UV-IR cut-off filter 53, the 1st lens array 54, and the 1st reflective mirror, the 2nd lens array 56, and the 1st dichroic mirror, G, and B colored light reflection, the R colored light 58 penetrates it, and G and the B colored light 59 reflect it.

[0009] the R colored light 58 is the 2nd reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- it is reflected by 60 and incidence is carried out to the liquid crystal panel 63 for R colored light which is a 1st transparency type liquid crystal panel through a condensing lens 61 and a polarizing plate 62

[0010] Incidence is carried out to the dichroic mirror 64 of G colored light reflection which is the 2nd dichroic mirror, and B colored light transparency, the G colored light 65 reflects, and the B colored light 66 penetrates G and the B

colored light 59. Incidence of the G colored light 65 is carried out to the liquid crystal panel 69 for G colored light which is a 2nd transparency type liquid crystal panel through a condensing lens 67 and a polarizing plate 68.

[0011] the B colored light 66 is a relay lens 70 and the 3rd reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- they are 71, a relay lens 72, and the 4th reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- incidence is carried out to the liquid crystal panel 76 for B colored light which is a 3rd transparency type liquid crystal panel through 73, a condensing lens 74, and a polarizing plate 75

[0012] Color composition is carried out with a dichroic prism 80, and the R transmitted light 77 from a liquid crystal panel 63, the G transmitted light 78 from a liquid crystal panel 69, and the B transmitted light 79 from a liquid crystal panel 76 project the outgoing radiation light 81 by which color composition was carried out on a screen (not shown) with the projection lens 82.

[0013] In order to make it the heat generated from the light source which becomes an elevated temperature not influence a component part, near [ which is the light source ] a metal halide lamp 50 and the lamp reflector 52, the ventilating fan 83 for light source cooling is arranged, and hot blast 84 is exhausted besides the case (not shown) of a liquid crystal projector.

[0014] According to the liquid crystal projector of this composition, the picture of a big screen is brightly acquired on a screen, cooling the light source which becomes an elevated temperature.

[0015] However, in the liquid crystal projector of this conventional composition, the technical problem that the hot blast 84 exhausted by the ventilating fan 83 may flow in the direction of the view \*\* person located near the liquid crystal projector, and will give a view \*\* person displeasure occurred.

[0016] Moreover, although a liquid crystal projector may place and use visual equipments, such as a personal computer, for near, it needs consideration of putting a weak device on the position where hot blast does not hit for these heat.

Moreover, in order to exhaust efficiently the heat generated from the light source, the consideration it is made not to place an object which interrupts this exhaust air is also required for the position where hot blast is exhausted, and there was a problem on user-friendliness nature.

[0017] On the other hand, the fan for exhaust air as an object for cooling of the light source is stationed to the same field as the field which has arranged the front cylinder part of a projection lens, and the composition which made the projection direction and the exhaust air direction the same direction is proposed as indicated by JP,5-59424,U, for example. According to this, the hot blast exhausted from the ventilating fan does not flow in the direction of the view \*\* person located near the liquid crystal projector, and does not give a view \*\* person displeasure. Moreover, the good liquid crystal projector of user-friendliness nature also with consideration unnecessary when arranging a weak device with heat near the liquid crystal projector and, and the unnecessary consideration it is made not to place an object which interrupts exhaust air in the position where hot blast is exhausted is obtained. However, with this conventional technology, consideration, such as a cure about the point which the hot blast from a ventilating fan may flow and fluctuation may produce in the projection picture of a screen in the projection light from a projection lens, was not carried out. Moreover, there was no consideration also especially about the composition which makes hot blast exhaust more efficiently. Moreover, there was no consideration also about the composition of the optical system containing the 1st lens array and the 2nd lens array.

[0018]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to offer the good liquid crystal projector of the high performance and user-friendliness nature which the hot blast exhausted from a ventilating fan can have a bad influence neither on a view \*\* person nor the device arranged on near, can display the picture which does not have fluctuation in a screen, and can exhaust the air in equipment efficiently because of cooling.

[0019]

[Means for Solving the Problem] By this invention, in order to attain the above-mentioned purpose, it is made to incline to the direction of a projection lens optical axis, and allots so that the light from the light source is irradiated at a liquid crystal panel, a projection lens may be approached, and the ventilating fan which exhausts the air in (1) equipment outside may be allotted in the liquid crystal projector which projects the outgoing radiation light from this liquid crystal panel on a screen with a projection lens and the exhaust stream may keep away from the projection light of a projection lens.

[0020] (2) the wind direction inclined and allotted to the direction of a projection lens optical axis so that the exhaust stream of a ventilating fan might keep away from the projection light of a projection lens -- it has a board

[0021] (3) two or more wind directions the degree of tilt angle of the thing of the side near a projection lens and the degree of tilt angle of the thing of a side far from a projection lens were made to differ while inclining and allotting to the direction of a projection lens optical axis so that the exhaust stream of a ventilating fan might keep away from the projection light of a projection lens -- it has a board

[0022] (4) two or more wind directions which made the degree of tilt angle of the thing of the side near a projection lens larger than the degree of tilt angle of the thing of a side far from a projection lens while inclining and allotting to the direction of a projection lens optical axis so that the exhaust stream of a ventilating fan might keep away from the projection light of a projection lens -- it has a board

[0023] (5) Carry out incidence of the light from the light source to the 1st dichroic mirror through the 1st lens array, the 1st reflective mirror, and the 2nd lens array. The 1st outgoing radiation light by which color separation was carried out with this 1st dichroic mirror is irradiated through the 2nd reflective mirror at the 1st liquid crystal panel. Incidence of the 2nd outgoing radiation light by which color separation was carried out with this 1st dichroic mirror is carried out to the 2nd dichroic mirror. Incidence of the 1st outgoing radiation light by which color separation was carried out with this 2nd dichroic mirror is carried out to the 2nd liquid crystal panel. The 2nd outgoing radiation light by which color separation was carried out with this 2nd dichroic mirror is carried out to the 2nd liquid crystal panel. The 3rd reflective mirror, The 3rd liquid crystal panel is irradiated through the 4th reflective mirror. The transmitted light from the 1st liquid crystal panel of the above, The transmitted light from the 2nd liquid crystal panel of the above, and the transmitted light from the 3rd liquid crystal panel of the above It is the liquid crystal projector which carries out color composition with a dichroic prism, and projects on a screen this outgoing radiation light by which color composition was carried out with a projection lens. The reflective mirror of the above 1st, the 2nd lens array, the 1st dichroic mirror, The 2nd dichroic mirror and the 3rd reflective mirror are allotted to this order. And the 1st reflective mirror, The 1st lens array, the light source, and a ventilating fan are arranged in this order, and the lists of the 1st reflective mirror, the 1st lens array, the light source, and a ventilating fan are abbreviation parallel, and it is made to allot next to the list of a projection lens, a dichroic prism, and the 2nd dichroic mirror.

[0024] [Embodiments of the Invention] Hereafter, the example of this invention is explained using a drawing.

[0025] Drawing 1 is drawing showing the 1st example of this invention, and is the plan of liquid crystal projector optical system.

[0026] Incidence of the lighting light 2 from the metal halide lamp 1 which is the light source is carried out to the 1st lens array 4 through the lamp reflector 3 of an ellipsoid mirror. Here, the lamp reflector 5 of a spherical mirror returns again the lighting light 6 which was not used to a metal halide lamp 1 conventionally from a metal halide lamp 1, and it prepares it in order to aim at reuse of light. The plane of incidence 7 can make the 1st lens array 4 a concave lens side, and it can make the 1st lens array small by giving the operation which changes the convergence light 8 from the lamp reflector 3 of an ellipsoid mirror into abbreviation parallel light.

[0027] the outgoing radiation light 9 from the 1st lens array 4 is the 1st reflective mirror -- an increase -- reflection -- silver -- a mirror -- incidence is carried out to the dichroic mirror 12 of B colored light reflection which is 10, the 2nd lens array 11, and the 1st dichroic mirror, G, and R colored light transparency, the B colored light 13 reflects, and G and the R colored light 14 penetrate the B colored light 13 is the 2nd reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- it is reflected by 15 and incidence is carried out to the liquid crystal panel 18 for B colored light which is a 1st transparency type liquid crystal panel through a condensing lens 16 and a polarizing plate 17 Incidence is carried out to the dichroic mirror 19 of G colored light reflection which is the 2nd dichroic mirror, and R colored light transparency, the G colored light 20 reflects, and the R colored light 21 penetrates G and the R colored light 14. Incidence of the G colored light 20 is carried out to the liquid crystal panel 24 for G colored light which is a 2nd transparency type liquid crystal panel through a condensing lens 22 and a polarizing plate 23. the R colored light 21 is a relay lens 25, the cold mirror 26 which penetrates the infrared radiation which is the 3rd reflective mirror, a relay lens 27, and the 4th reflective mirror -- an increase -- reflection -- silver -- a mirror -- incidence is carried out to the liquid crystal panel 31 for R colored light which is a 3rd transparency type liquid crystal panel through 28, a condensing lens 29, and a polarizing plate 30

[0028] Color composition is carried out with a dichroic prism 35, and the B transmitted light 32 from a liquid crystal panel 18, the G transmitted light 33 from a liquid crystal panel 24, and the R transmitted light 34 from a liquid crystal panel 31 project the outgoing radiation light 36 by which color composition was carried out on a screen (not shown) with the projection lens 37.

[0029] In order that the heat generated from the light source which becomes an elevated temperature does not do influence and may carry out it to component parts other than the light source, near the metal halide lamp 1 and the lamp reflector 3 which are the light source, and the lamp reflector 5, the ventilating fan 38 for light source cooling is arranged, and hot blast 39 is exhausted besides the case of a liquid crystal projector. As arranged a ventilating fan 38 next on the projection lens 37 and kept away in 39 of the exhaust air style of a ventilating fan 38 from the projection light 36 of the projection lens 37, it inclines and a ventilating fan 38 is arranged. It can prevent that set up with the degree of tilt angle of b= 15 degrees of a ventilating fan, the hot blast 39 exhausted from the ventilating fan 38 in the

projection light 36 from the projection lens 37 flows to the angle of  $a = 30$  degrees of projection light 36a by the side of 39 of the exhaust air style of the projection light 36, and the projection picture to a screen swings.

[0030] moreover, the projection lens 37 is adjoined, and a ventilating fan 38 is arranged, and 39 of the exhaust air style of a ventilating fan 38 keeps away from the projection light 36 of the projection lens 37 -- as -- two or more wind directions -- while inclining and arranging a board 40 -- the wind direction of the side near the projection lens 37 -- the degree c of tilt angle of board 40a -- the wind direction of a side far from the projection lens 37 -- it is made larger than the degree d of tilt angle of board 40b For example, it has considered as the degree of tilt angle of  $c = 30$  degrees, and the degree of tilt angle of  $d = 15$  degrees. the angle of  $a = 30$  degrees of projection light 36a by the side of 39 of the exhaust air style of the projection light 36 -- receiving -- the wind direction of the side near the projection lens 37 -- the degree of tilt angle of  $c = 30$  degrees of board 40a, and abbreviation -- since it has set up equally, it can ease that hot blast 39a discarded from the ventilating fan 38 flows, and the projection picture to a screen swings in the projection light 36 from the projection lens 37 moreover, the degree of tilt angle of  $b = 15$  degrees of a blower fan 38 -- receiving -- the wind direction of a side far from the projection lens 37 -- the degree of tilt angle of  $d = 15$  degrees of board 40b, and abbreviation -- since it set up equally -- the course of hot blast 39 -- a wind direction -- since [ which is not things ] it is greatly bent by board 40b, it can be exhausted more efficiently 39 of exhaust air style with 39 of exhaust air style b near projection lens 37 with problem far from projection lens 37 side to which hot blast 39 exhausted from ventilating fan 38 flows, and projection picture to screen swings in projection light 36 from projection lens 37 b -- since influence is small -- such -- a wind direction -- the degree c of tilt angle of board 40a -- a wind direction -- the degree d of tilt angle of board 40b is made smaller

[0031] In this example, the 1st outgoing radiation light 13 separated by the 1st dichroic mirror 12 with the reflected light of the 1st dichroic mirror 12, and the 1st dichroic mirror 12 So that the 2nd separated outgoing radiation light 14 may turn into the transmitted light of the 1st dichroic mirror 12 The metal halide lamp 1 which the 1st reflective mirror 10, the 2nd lens array 11, the 1st dichroic mirror 12, the 2nd dichroic mirror 19, and the 3rd reflective mirror 26 are arranged in this order, and are the 1st reflective mirror 10, the 1st lens array 4, and the light source, Arrange a ventilating fan 38 in this order, and the list of the 1st reflective mirror 10, the 1st lens array 4, the metal halide lamp 1 that is the light source, and a ventilating fan 38 receives the list of the projection lens 37, a dichroic prism 35, and the 2nd dichroic mirror 19. It is abbreviation parallel and arranges next.

[0032] According to the liquid crystal projector of this example composition, it will flow in the direction as the outgoing radiation light 36 of the projection lens 37 where the hot blast 39 exhausted by the ventilating fan 38 is the same. Since the view \*\* person itself interrupts the outgoing radiation light 36 and makes the picture to a screen generate a shadow, a view \*\* person must have been located near the direction of the outgoing radiation light 36 of the projection lens 37. Therefore, displeasure is not given to this view \*\* person in order not to flow in the direction of the view \*\* person located near the liquid crystal projector.

[0033] Moreover, even if it uses it near the liquid crystal projector for the same reason, placing visual equipments, such as a personal computer, the consideration about the position which hot blast does not hit a device weak with these heat, and is placed is unnecessary. Moreover, in order to exhaust efficiently the heat generated from the light source, the consideration it is made not to put an object which interrupts exhaust air on the position where hot blast is exhausted is also unnecessary, and can raise user-friendliness nature.

[0034] Moreover, in this example, B colored light is reflected, it considers as the spectral characteristic which penetrates G colored light and R colored light, the 2nd dichroic mirror 19 reflects G colored light, and the 1st dichroic mirror 12 can increase B colored light component relatively by having considered as the spectral characteristic which penetrates R colored light compared with R colored light component. This is because only B colored light can use only by reflection by each mirrors 10, 12, and 15 and can use S polarization component with a higher reflection factor compared with P polarization component. There is an effect which raises by this the white projected on a screen to desirable color temperature. When it was such material, even if there were some (for example, a polarizing plate and a liquid crystal panel) to which the efficiency for light utilization of B colored light is reduced in glass and plastic material of the optic especially used for a liquid crystal projector, and it used the light source of the same color temperature, the fall of color temperature was not avoided. However, with the composition which this invention requires, since it can make the most of B colored light component, the fall of this color temperature can be kept to the minimum.

[0035] In addition, since relay lenses 25 and 27 and the reflective mirrors 26 and 28 will be used too much by R colored light compared with B colored light or G colored light, the quantity of light falls by the permeability and reflection factor loss.

[0036] then -- this example -- the increase of the reflective mirror of \*\* a 1st -- reflection -- silver -- a mirror -- the cold mirror 26 which sets to 10 and penetrates infrared radiation for the 3rd reflective mirror -- carrying out -- the increase of the reflective mirror of \*\* a 4th -- reflection -- silver -- a mirror -- it is referred to as 28

[0037] the increase of drawing 2 -- reflection -- silver -- a mirror -- it is the graph which shows a spectral-reflectance property Moreover, drawing 3 is the graph of the spectral transmittance of a cold mirror. the increase of this drawing -- reflection -- silver -- a mirror -- compared with a cold mirror, it turns out that a reflection factor is high Since especially R colored light will use the transmitted light of dichroic mirrors 12 and 19, compared with S polarization component, you should use P polarization component with higher permeability. then, the reflection factor of P polarization component is more high -- an increase -- reflection -- silver -- a mirror -- the fall of R colored light can be kept by adopting 10 and 28 to the minimum in addition -- an increase -- reflection -- silver -- a mirror -- interception of unnecessary infrared radiation and ultraviolet rays is needed with 10 or 28 adoption Then, in this example, the 3rd reflective mirror is considered as the cold mirror 26 which penetrates infrared radiation. It can avoid irradiating infrared radiation detrimental to a polarizing plate 30 and a liquid crystal panel 31 by this.

[0038] Moreover, in this example, UV cut-off filter which intercepts ultraviolet rays between the optical paths of the polarizing plate 17 and the 1st dichroic mirror 12 which are arranged at the incidence side of the 1st liquid crystal panel 18 is arranged. Furthermore, in this example, UV cut-off filter 17a is formed also in the plane of incidence of a polarizing plate 17.

[0039] in addition, in the example of \*\*\*\* 1, 39 of the exhaust air style of a ventilating fan 38 keeps away from the projection light 36 of the projection lens 37 -- as -- two or more wind directions [ \*\*\*\* / inclining and arranging a ventilating fan 38 ], while inclining and arranging a board 40 the wind direction of the side near the projection lens 37 -- the degree c of tilt angle of board 40a -- the wind direction of a side far from the projection lens 37 -- although set up more greatly than the degree d of tilt angle of board 40b, it is not limited to this

[0040] Drawing 4 is drawing showing the 2nd example of this invention, and is the plan of liquid crystal projector optical system. the point that the ventilating fan 38 is not arranged by inclining, and a wind direction, except for the point which is not illustrated about the composition of a board 40, it is the same composition as the 1st example of this invention The consideration to the device which the hot blast 39 exhausted from the ventilating fan 38 like [ in this example ] the 2nd example does not flow in the direction of the view \*\* person located near the liquid crystal projector, and does not give a view \*\* person displeasure, and arranges near the liquid crystal projector is unnecessary, and the consideration it is made not to place an object which interrupts exhaust air in the position where hot blast is exhausted is also unnecessary. Thus, according to this invention, a user-friendly liquid crystal projector can be obtained.

[0041] Drawing 5 is drawing showing the 3rd example of this invention, and is the plan of the optical system.

[0042] Incidence is carried out to the dichroic mirror 40 of R colored light reflection which is the cold mirror 55 which are the lamp reflector 52 of a parabolic mirror, the UV-IR cut-off filter 53, the 1st lens array 54, and the 1st reflective mirror, the 2nd lens array 56, and the 1st dichroic mirror, G, and B colored light transparency, the R colored light 58 reflects, and G and the B colored light 59 penetrate the light 51 from the metal halide lamp 50 of the light source. the R colored light 58 is the 2nd reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- it is reflected by 60 and incidence is carried out to the liquid crystal panel 63 for R colored light which is a 1st transparency type liquid crystal panel through a condensing lens 61 and a polarizing plate 62 Incidence is carried out to the dichroic mirror 64 of G colored light reflection which is the 2nd dichroic mirror, and B colored light transparency, the G colored light 65 reflects, and the B colored light 66 penetrates G and the B colored light 59. Incidence of the G colored light 65 is carried out to the liquid crystal panel 69 for G colored light which is a 2nd transparency type liquid crystal panel through a condensing lens 67 and a polarizing plate 68. the B colored light 66 is a relay lens 70 and the 3rd reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- they are 71, a relay lens 72, and the 4th reflective mirror -- an increase -- reflection -- aluminum -- a mirror -- incidence is carried out to the liquid crystal panel 76 for B colored light which is a 3rd transparency type liquid crystal panel through 73, a condensing lens 74, and a polarizing plate 75

[0043] Color composition is carried out with a dichroic prism 80, and the R transmitted light 77 from a liquid crystal panel 63, the G transmitted light 78 from a liquid crystal panel 69, and the B transmitted light 79 from a liquid crystal panel 76 project the outgoing radiation light 81 by which color composition was carried out on a screen (not shown) with the projection lens 82.

[0044] In order to make it the heat generated with the hot light source not affect component parts other than the light source, near the metal halide lamp 50 of the light source, and the lamp reflector 52, the ventilating fan 38 for light source cooling is arranged, and hot blast 39 is exhausted besides the case (not shown) of a liquid crystal projector.

[0045] In this example The 1st outgoing radiation light 58 separated by the 1st dichroic mirror 40 with the reflected light of the 1st dichroic mirror 40, and the 1st dichroic mirror 40 So that the 2nd separated outgoing radiation light 59 may turn into the transmitted light of the 1st dichroic mirror 40 The 1st reflective mirror 55, the 2nd lens array 56, the 1st dichroic mirror 40, the 2nd dichroic mirror 64, and the 3rd reflective mirror 71 are arranged in this order. And the 1st reflective mirror 55, the 1st lens array 54, the metal halide lamp 50 of the light source, A ventilating fan 38 is arranged in this order. and the 1st reflective mirror 55, the 1st lens array 54, the metal halide lamp 50 of the light source, and the

list of a ventilating fan 38 To the list of the projection lens 82, a dichroic prism 80, and the 2nd dichroic mirror 64, it is abbreviation parallel and arranges next.

[0046] Since the hot blast 39 exhausted by the ventilating fan 38 will flow in the same direction as the outgoing radiation light 81 of the projection lens 82 according to this example, the same effect as the case of the 2nd example of the above is acquired.

[0047]

[Effect of the Invention] As mentioned above, according to this invention, as explained, while that consideration to the temperature rise of the device which does not give a view \*\* person displeasure and is arranged to near can also be made unnecessary etc. can obtain the good liquid crystal projector of user-friendliness nature, fluctuation of the projection picture of the screen by the hot blast exhausted from the ventilating fan can also be prevented. Moreover, exhaust air efficiency can be raised and cooling efficiency can be raised.

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[Translation done.]

**\* NOTICES \***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

**DRAWINGS****[Drawing 1]**

図 1

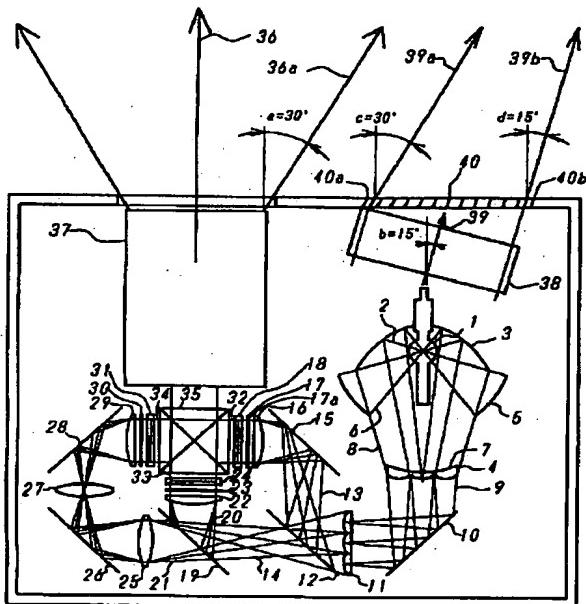
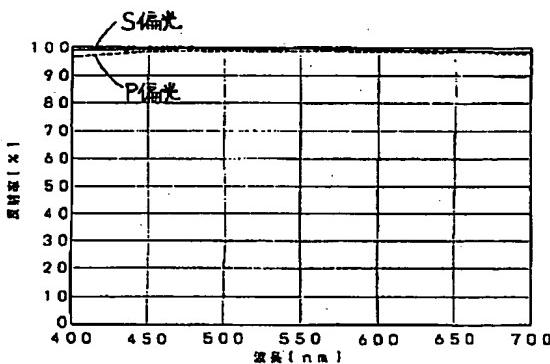
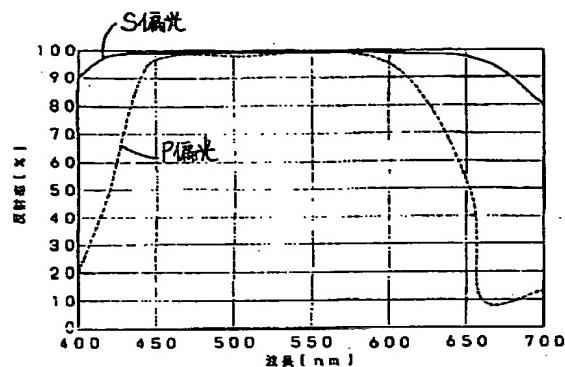
**[Drawing 2]**

図 2

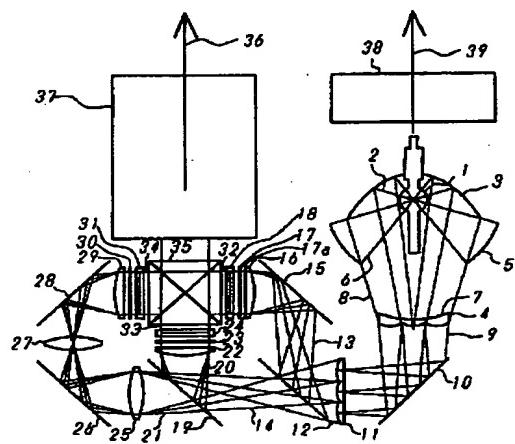
**[Drawing 3]**

3



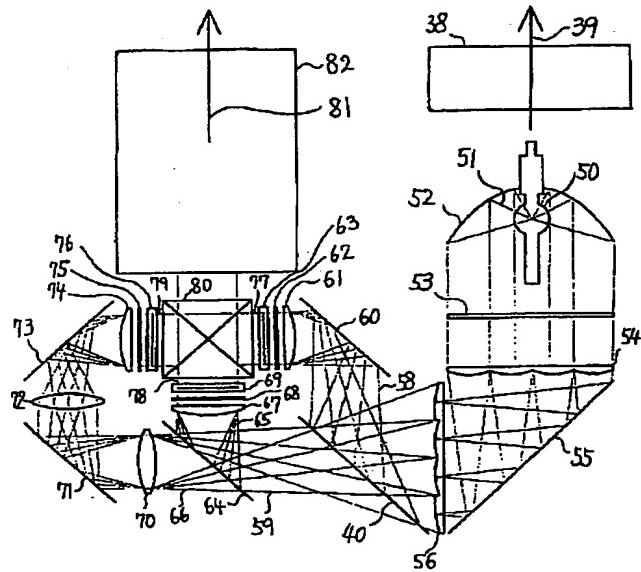
### [Drawing 4]

4



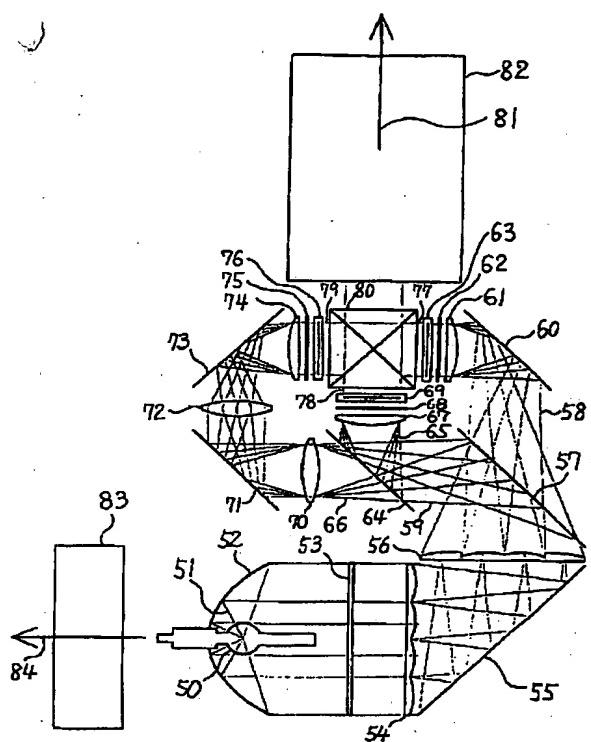
[Drawing 5]

5



[Drawing 6]

(X) 6



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[Translation done.]

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**CORRECTION or AMENDMENT**

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law

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G03B 21/16

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B01J 23/58 M

23/60 M

23/80 M

23/86 M

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G03B 33/12

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[Filing Date] March 6, Heisei 15 (2003. 3.6)

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] The name of invention

[Method of Amendment] Change

[Proposed Amendment]

[Title of the Invention] Projected type display

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim

[Method of Amendment] Change

[Proposed Amendment]

[Claim(s)]

[Claim 1] It is the projected type display which irradiates the light from the light source at a graphic display element, and projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens.

It is in the case of equipment, and the field of the side which has arranged the projection lens is approached, and it has the ventilating fan inclined and arranged to the direction of a projection lens optical axis.

Projected type display characterized by exhausting to the aforementioned case exterior as the air in the aforementioned case is kept away from the projection light of the aforementioned projection lens.

[Claim 2] It is the projected type display which irradiates the light from the light source at a graphic display element, and projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens.

An exhaust air means to exhaust the air in the case of equipment outside,

the wind direction exhausted to the aforementioned case exterior as keeps away the air in the aforementioned case from the projection light of the aforementioned projection lens -- the projected type display characterized by having a change means

[Claim 3] It is the projected type display which irradiates the light from the light source at a graphic display element, and projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens.

The ventilating fan which exhausts the air in the case of equipment outside,

the field of the side which is in the aforementioned case and has arranged the projection lens -- and the wind direction inclined and arranged to the direction of a projection lens optical axis -- a board -- having

Projected type display characterized by exhausting to the aforementioned case exterior as the air in the aforementioned case is kept away from the projection light of the aforementioned projection lens.

[Claim 4] It is the projected type display which irradiates the light from the light source at a graphic display element, and projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens.

The ventilating fan which is in the case of equipment, and approached the field of the side which has arranged the projection lens, and inclined to the direction of a projection lens optical axis, and has been arranged, the field of the side which is in the aforementioned case and has arranged the projection lens -- and the wind direction inclined and arranged to the direction of a projection lens optical axis -- a board -- having

Projected type display characterized by exhausting to the aforementioned case exterior as the air in the aforementioned case is kept away from the projection light of the aforementioned projection lens.

[Claim 5] the above -- a wind direction -- the wind direction of a side with the board near this projection lens to the direction of a projection lens optical axis -- the degree of tilt angle of a board, and the wind direction of a side far from this projection lens to this projection lens optical-axis direction -- projected type display given in any 1 term of the claim 3 characterized by arranging so that the degrees of tilt angle of a board may differ, or a claim 4

[Claim 6] the above -- a wind direction -- the wind direction of a side with the board near this projection lens to the direction of a projection lens optical axis -- the wind direction of a side with the degree of tilt angle of a board far from this projection lens to this projection lens optical-axis direction -- the projected type display according to claim 5 characterized by arranging so that it may become size from the degree of tilt angle of a board

[Claim 7] the above -- a wind direction -- the wind direction of a side with the board near this projection lens to the direction of a projection lens optical axis -- the degree of tilt angle of the side of the exhaust air style [ the degree of tilt angle of a board / the projection light of this projection lens to this projection lens optical-axis direction ], and abbreviation -- the projected type display according to claim 6 characterized by arranging so that it may become equal

[Claim 8] the above -- a wind direction -- projected type display given in any 1 term of the claim 5 characterized by a board consisting of two or more sheets, or a claim 7

[Claim 9] It is the projected type display which irradiates the light from the light source at a graphic display element, and projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens.

The cooling fan which cools the light source at least, the field of the side which is in the case of equipment and has arranged the projection lens -- and the wind direction inclined and arranged to the direction of a projection lens optical axis -- a board -- having Projected type display characterized by exhausting to the aforementioned case exterior as the air in the aforementioned case is kept away from the projection light of the aforementioned projection lens.

[Claim 10] It is the projected type display which irradiates the light from the light source at a graphic display element, and projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens.

It has the ventilating fan which exhausts the air in the aforementioned equipment outside.

This ventilating fan is projected type display characterized by exhausting to the aforementioned equipment exterior from the field of the side which has arranged the aforementioned projection lens as the air in the aforementioned equipment is kept away from the projection light of the aforementioned projection lens.

[Claim 11] Light source,

The graphic display element by which the light from the aforementioned light source is irradiated,

The projection lens which projects the outgoing radiation light from the aforementioned graphic display element,

It has the ventilating fan which exhausts the air in equipment outside.

This ventilating fan is projected type display characterized by exhausting to the aforementioned equipment exterior from the field of the side which has arranged the aforementioned projection lens as the air in the aforementioned equipment is kept away from the projection light of the aforementioned projection lens.

[Claim 12] Light source,

The graphic display element by which the light from the aforementioned light source is irradiated,

The projection lens which projects the outgoing radiation light from the aforementioned graphic display element,

It has the ventilating fan which exhausts the air in equipment to the equipment exterior.

The aforementioned ventilating fan is exhausted to the equipment exterior from the field of the side which has arranged the aforementioned projection lens of an equipment case.

Projected type display characterized by the direction of the projection light by the side of the aforementioned ventilating fan of the aforementioned projection lens and the exhaust air direction wind of the side near the aforementioned projection lens of the aforementioned ventilating fan being abbreviation parallel.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0019

[Method of Amendment] Change

[Proposed Amendment]

[0019]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in this invention, the light from the light source is irradiated at a graphic display element. It is the projected type display which projects the outgoing radiation light from the aforementioned graphic display element on a screen with a projection lens, and has the ventilating fan which exhausts the air in the aforementioned equipment outside. this ventilating fan As the air in the aforementioned equipment is kept away from the projection light of the aforementioned projection lens, it constitutes so that it may exhaust to the aforementioned equipment exterior from the field of the side which has arranged the aforementioned projection lens.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0020

[Method of Amendment] Deletion

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0021

[Method of Amendment] Deletion

[Procedure amendment 6]

[Document to be Amended] Specification

[Item(s) to be Amended] 0022

[Method of Amendment] Deletion

[Procedure amendment 7]

[Document to be Amended] Specification

[Item(s) to be Amended] 0023

[Method of Amendment] Deletion

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[Translation done.]

